NAKANISYNTH: An Intuitive Freehand Drawing Waveform Synthesiser Application for iOS Devices

Kyosuke Nakanishi
Tokyo Metropolitan University
6-6 Asahigaoka Hino-shi
Tokyo, Japan 191-0065
kyoro920@gmail.com

Paul Haimes
Tokyo Metropolitan University
6-6 Asahigaoka Hino-shi
Tokyo, Japan 191-0065
haimes@tmu.ac.jp

Tetsuaki Baba
Tokyo Metropolitan University
6-6 Asahigaoka Hino-shi
Tokyo, Japan 191-0065
baba@tmu.ac.jp

Kumiko Kushiyama
Tokyo Metropolitan University
6-6 Asahigaoka Hino-shi
Tokyo, Japan 191-0065
kushi@tmu.ac.jp

ABSTRACT

NAKANISYNTH is a synthesiser application available on iOS devices that provides a simple and intuitive interface, allowing users to produce sound loops by freehand drawing sound waves and envelope curves. The interface provides a simple way of interacting: the only input required involves drawing two waveforms, meaning that users can easily produce various sounds intuitively without the need for complex manipulation. The application's interface comprises of an interchangeable ribbon and keyboard feature, plus two panels where users can edit waveforms, allowing users to make sounds. This simple approach to the interface means that it is easy for users to understand the relationship between a waveform and the sound that it produces.

Author Keywords

waveforms, digital synthesis, iOS, multi-touch, freehand drawing

ACM Classification

H.5.5 [Information Interfaces and Presentation] Sound and Music Computing, J.5 [Arts and Humanities] Music, H.1.2 [User/Machine Systems] Human Factors.

1. INTRODUCTION

Most musical synthesisers have several parameters for producing sounds. These synthesisers can manipulate sounds in intricate ways, but their interfaces tend to be complex — particularly in more traditional modular systems, e.g. [5]. Therefore, users who wish to obtain proficiency with these instruments need to invest significant amounts of time to learn how to use these devices, which may be a barrier to entry for those who wish to explore sounds creatively without the cognitive burden of learning a complicated system. In this context, we are exploring freehand drawing waveforms as an alternative to the manipulation of several parameters.

NIME'16, July 11-15, 2016, Griffith University, Brisbane, Australia.
.

2. RELATED WORK

Over the past decade, smart phone applications have been created to allow users to generate sounds through simple interfaces manipulable through a phone's touchscreen. *Bloom*, a collaboration between musician Brian Eno and software designer Peter Chilvers, was one early example [1]. Described as a combination of an instrument, composition tool and artwork, Bloom allows "anyone to create elaborate patterns and unique melodies by simply tapping the screen" [1]. *Control* is another more recent application that utilised a simple smart phone interface for use in real-time performance and composition [9]. The multi-touch screen technology of smart phones means that several parameters can be accessed while simultaneously composing or performing, allowing for multimodal input [11].

In the field of new interfaces for musical expression, there are precedents of creating sounds based on freehand drawn waveforms.

Iannis Xenakis foresaw the use of hand-drawn interfaces as a way of controlling parameters for producing sound with synthesisers. Xenakis' *UPIC* (Unité Polyagogique Informatique du CeMaMu) system, developed in the 1960s and 70s, "pioneered the use of graphical interfaces for music composition by introducing freehand drawing to control sonic events" [12]. In the UPIC system, drawings created on a tabletop device were used to control parameters such as pitch and dynamics [12]. Similar techniques were also used in the *Fairlight CMI* (computer musical instrument) synthesiser, which utilised a light-pen for drawing waveforms [2].

There are recent works that use similar techniques of converting a freehand drawing waveform into a sound. *Wavetable* [10] and *Graph-Sono* [4] are both musical interfaces that enable users to draw waveforms.

Wavetable used a tabletop interface and utilised tangible interaction and multi-touch to allow users to interact with the system. The application included a number of tools including editing tools (eraser, copy, paste and gain), effects (delay, reverb and bit-crush) and file tools (recording, opening and saving) [10].

Meanwhile, the Graph-Sono system (Fig. 1) used a video camera to detect lines drawn by users on a piece of paper [4]. The camera was connected to an Apple Macbook laptop running Max/MSP, which generated sine-wave sounds [4].

Although these systems used the drawing of wave shapes to generate sounds, such systems may not be easily accessible to novice users, nor musicians wishing to easily incor-

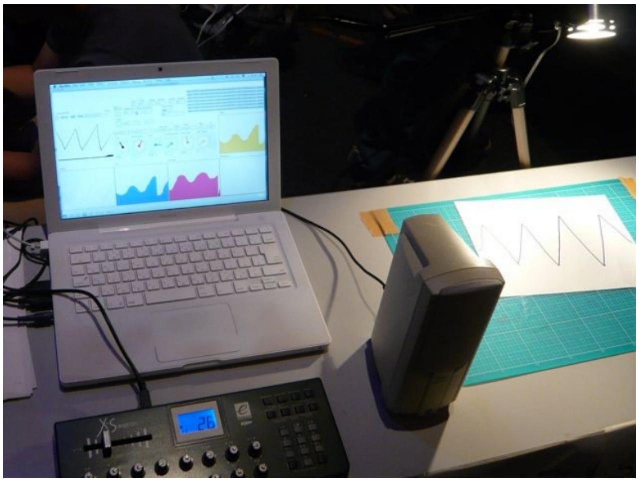

Figure 1: The Graph-Sono system [4] uses a video camera to detect lines drawn by users on a piece of paper. The camera is connected to an Apple Macbook laptop running Max/MSP, which generates sine-wave sounds.

porate them into live performances. However, the ability of smart phone applications to provide a simple interface to users — particularly those with little or no formal musical training — means some of the functionality of complex systems such as UPIC and Graph-Sono can now be delivered via an easy to use multimodal interface.

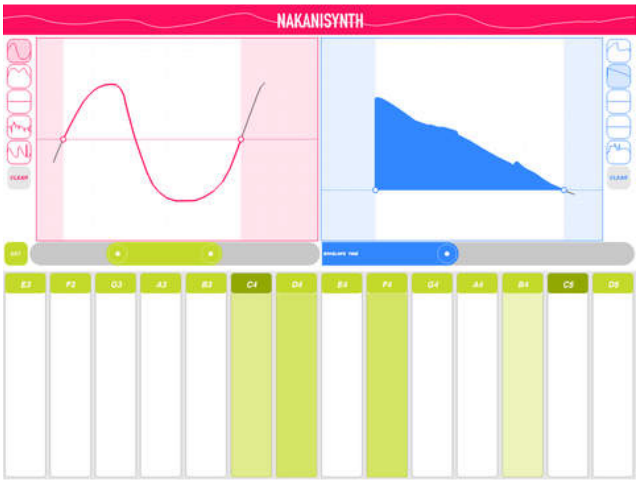

Figure 2: The application's interface showing the sound wave drawing area on the left and the envelope curve drawing area on the right. The bottom part of the screen shows the keyboard control, which is loaded by default.

3. OUR SYSTEM

NAKANISYNTH is an iOS application developed with open-Frameworks — an open source C++ framework — [7] and Pure Data [8].

The application runs on iPad, iPod Touch and iPhone devices, provided that they are running iOS 6.1 or later. The upper half of the screen is used for drawing two waveforms and the lower half is used to play sounds using either a keyboard interface (Fig. 2) or a ribbon interface (Fig. 3).

By creating this application, we have removed the need for complex controllers from the interface to make it more simple and intuitive for novice users. This simplicity also means that users learn to understand the effect that a waveform has on the sounds generated. In the following sections, we describe aspects of the system in further detail. A video overview of the system is also available online [6].

3.1 Freehand drawing waveforms

Users can draw a waveform of any length in any position within the two waveform drawing areas. The waveform on the left side of the screen is a sound wave. The waveform on the right side is an envelope curve. In both of the waveform drawing areas, the value of the vertical axis means amplitude and the value of the horizontal axis means time. The drawn waveform data is interpolated with linear interpolation based on the sample rate and the maximum length of wave data used within the application, which is stored in an array. A maximum of five waves' data can be saved. The saved wave shapes are shown to the side of both wave drawing areas (Shown in figures 2 and 3). A frequency is generated by resampling the array. It is easy to observe the differences in sounds created by the drawn waveforms because users can easily edit and change waveforms while simultaneously making sounds. Data from the two waveforms is processed by Pure Data patches. The main Pure Data patch has two arrays: the first is for a cycle of sound and the second is for the envelope curve. A second Pure Data patch calculates the output from the two waveforms, along with the inputed MIDI note, frequency of the envelope and velocity.

3.2 Playing Sounds

Users can make a maximum of 10 sounds simultaneously by touching the sound generation area, which is represented as either a standard keyboard (Fig. 2) or a ribbon controller (Fig. 3), depending on which option the user selects, with the keyboard being the default option. The frequency increases from the left to the right of this area. Users can also change the frequency range with a green slider above the ribbon/keyboard controller (Shown below the wave drawing area on the left in figures 2 and 3).

In the ribbon controller mode, the frequency changes continuously so that users can make a beat sound or vibrato. The volume becomes louder from the bottom to the top of the playing sound area, which users can also adjust manually. The cycle of envelope loops is adjusted with a blue slider (Shown below the wave drawing area on the right in figures 2 and 3). Therefore, the user can make a looped melody and modulate it by shortening the cycle time. In order to make it easy to imagine the relationship between the waveform and the generated sound, a visualisation of the waveforms' sound output is shown above the drawing area.

4. EARLY RESULTS OF USER TESTING

Although we are yet to conduct formal user testing, we have exhibited the application at several events in Japan. During these exhibitions we conducted informal user testing, where observations and feedback from users suggested that it is a useful and enjoyable device to use. The majority of people — including children — who used it enjoyed producing sounds with it.

In 2015 the app was released in Apple's iTunes App Store [3]. The feedback obtained from users who downloaded the app through the iTunes App Store has been generally positive, with the application averaging 4.5 stars out of 5.

5. DISCUSSION AND FUTURE WORK

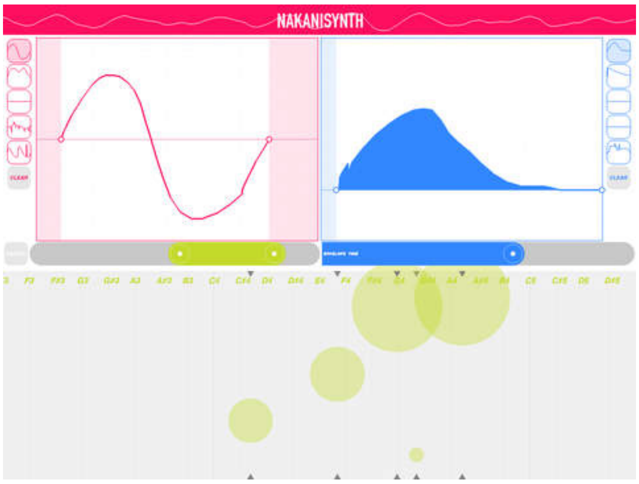

Figure 3: The application's interface with the ribbon controller option selected, which is shown in the bottom half of the screen. The green circles signify touch events, which increase in size towards the top of the ribbon controller area demonstrate the increase in volume.

In this work, we focused on the intelligibility of sound synthesis, in the hope that users can recognise a link between the waveforms they have drawn and the sound that they have produced. By creating a system that relies on a platform as ubiquitous as iOS devices, we hope to bring waveform-drawing synthesis to a broader audience, as previous attempts have generally relied on more complicated systems that require additional hardware.

In future versions, we may add functions such as modulation and other effects, but will aim to retain the intuitiveness and simplicity of the current version. We will also conduct further user testing when these changes are made to verify that it has retained its ease of use. It is hoped that this application will become a viable instrument for music composition and live performance.

6. CONCLUSION

By creating a simple interface and only minimal parameters for users to work with, we have created a software synth that is intuitive and easy for musicians of any ability to use.

By relying on a simple interface for producing sounds, we have created a very low learning curve for users. It is hoped that this simple approach will facilitate the creativity of users — with a particular focus on novice users, serving as a way of educating and promoting the use of digital synthesisers.

7. REFERENCES

[1] B. Eno and P. Chilvers. Generative Music: Creative apps for the iPad, iPhone and iPod touch, 2012. http://www.generativemusic.com/.

[2] J. Grant. The Fairlight Explained, 1984. http://www.virtual-music.at/download/fairlight/fairlight_cmi_explained.pdf.

[3] iTunes. iTunes Preview: NAKANISYNTH, 2015. https://itunes.apple.com/us/app/nakanisynth/id976936118?mt=8.

[4] S. Matsumura. Graph-Sono - Hand Drawing Sound. In *Proceedings of the 18th International Conference on Artificial Reality and Telexistence*, pages 356–357, 2009.

[5] Moog. The Moog Modular, 2015. http://www.moogmusic.com/content/moog-modular-synthesizers.

[6] NAKANISYNTH, 2016. http://nakanisynth.com/.

[7] openFrameworks. openFrameworks is an open source C++ toolkit for creative coding, 2015. http://www.openframeworks.cc.

[8] Pure Data. Pure Data, 2015. https://puredata.info/.

[9] C. Roberts, A. Forbes, and T. Hollerer. Enabling Multimodal Mobile Interfaces for Interactive Musical Performance. In *Proceedings of NIME 13, May 27-30, 2013, KAIST, Daejeon, Korea.*, 2013.

[10] G. Roma and A. Xambo. A tabletop waveform editor for live performance. In *Proceedings of New Interfaces for Music Expression*, pages 249–252. NIME, 2008.

[11] A. Tanaka. Mapping Out Instruments, Affordances, and Mobiles. In *Proceedings of the 2010 Conference on New Interfaces for Musical Expression (NIME 2010), Sydney, Australia.*, 2010.

[12] J.-B. Thiebaut, P. G. T. Healey, and N. B. Kinns. Drawing Electro-acoustic Music. In *Proceedings of the International Computer Music Conference(ICMC-08, Belfast)*, 2008. http://quod.lib.umich.edu/cgi/p/pod/dod-idx/drawing-electroacoustic-music.pdf.